Claims

1. An external-cavity tunable laser (60) configured to emit radiation at a laser emission wavelength, the tunable laser system comprising an external cavity having a plurality of cavity modes, said external cavity including
a gain medium (61) to emit an optical beam into the external cavity, and
a tunable optical resonant grating filter (66;20;40) reflecting the optical beam at a resonant wavelength, said filter comprising
a diffraction grating,
a planar waveguide (28;46) optically interacting with said diffraction grating, the diffraction grating and the planar waveguide forming a resonant structure, and
a light transmissive material having a selectively variable refractive index to permit tuning of the filter, said light transmissive material forming a tunable cladding (30;43) layer for the planar waveguide,
wherein the planar waveguide is placed between the diffraction grating and the tunable cladding layer.
2. The laser system of claim 1, wherein the emitted radiation is on a single longitudinal mode.
3. The laser system of claim 1, further comprising a channel-allocation grid element arranged in the external cavity to define a plurality of pass bands substantially aligned with corresponding channels of a selected wavelength grid.
4. The laser system of claim 3, wherein the tunable resonant grating filter is arranged in the external cavity to tunably select one of the pass bands so as to select a channel to which to tune the optical beam.
5. The laser system of claims 3 or 4, wherein the selected wavelength grid has a channel spacing of 50 GHz or 25 GHz.
6. The laser system of claim 1, wherein the tunable resonant grating filter being arranged in the external cavity so that the optical beam impinges on the filter substantially perpendicular to a main surface of the planar waveguide.
7. An optical resonant grating filter (20;40) reflecting optical radiation at a resonant wavelength, said filter comprising
a diffraction grating (23;52) having a periodic structure comprising low-index regions (21;53) and high-index regions (22;50), said diffraction grating having a coupling efficiency, η_d, not larger than 0.0026,

a planar waveguide (28;46) optically interacting with said diffraction grating, the diffraction grating and the planar waveguide forming a resonant structure, and

a light transmissive material having a selectively variable refractive index to permit tuning of the filter, said light transmissive material forming a tunable cladding (30;43) layer for the planar waveguide,

wherein the planar waveguide is placed between the diffraction grating and the tunable cladding layer.

8. The filter of claim 7, wherein the light transmissive material is a liquid crystal material whose selectively variable refractive index is controlled by an electric signal.

9. The filter of claim 7, wherein the coupling efficiency of the diffraction grating ranges from 0.001 to 0.002.

10. The filter of claim 7, wherein the planar waveguide is a layer having a refractive index n_C larger than the variable refractive index of the tunable cladding layer and of the average refractive index of the diffraction grating.

11. The filter of claim 10, further comprising a buffer layer (24,47) placed opposite to the diffraction grating with respect to the planar waveguide, said buffer layer having a refractive index n_3 being lower than the average refractive index of the diffraction grating.

12. The filter according to one of claims from 7 to 11, further comprising a gap layer (51) placed between the planar waveguide and the diffraction grating, said gap layer having a refractive index lower than that of the waveguide and than the average index of the diffraction grating. .

13. The filter of claims 11 or 12, wherein the planar waveguide is made of silicon nitride material, the high-index regions of silicon nitride or silicon oxynitride, and the low-index regions and the buffer layer are made of silicon dioxide.

14. The filter of claim 12, wherein the gap layer is made of silicon dioxide.

15. The filter of any of claims from 8 to 14, further comprising two light transparent electrically conducting layers (26;42;29;44) arranged on opposite sides of the light transmissive material for applying the electric signal across the light transmissive material.